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The influence of social cognition on ego disturbances in patients with schizophrenia

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The Influence of Social Cognition on Ego Disturbances in Patients with Schizophrenia

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Key Words

Schizophrenia · First-rank symptoms · Ego disturbances · Social causal attribution · Source monitoring

Abstract

Background: Subjects experiencing ego disturbances can be classified as a distinct subgroup of schizophrenia patients. These symptoms imply a disturbance in the ego-world boundary, which in turn implies aberrations in the perception, processing and understanding of social information. This paper provides a comparison of a group of schizophrenia patients and a group of healthy controls on a range of social-cognitive tasks. Furthermore, it analyzes the relationship between ego disturbances and social-cognitive as well as clinical variables in the schizophrenia subsample. **Methods:** Two groups – 40 schizophrenia patients and 39 healthy subjects – were compared. In the source monitoring task, subjects performed simple computer mouse movements and evaluated the partially manipulated visual feedback as either self- or other-generated. In a second step, participants indicated the confidence of their decision on a 4-point rating scale. In an emotion-recognition task, subjects had to identify 6 basic emotions in the prosody of spoken sentences. In the ‘reading-the-mind-in-the-eyes’ test, subjects had to infer mental states from pictures that depicted others’ eyes. In an attribution task, subjects were pre-

sented with descriptions of social events and asked to attribute the cause of the event either to a person, an object or a situation. Additionally, all subjects were tested for cognitive functioning levels. **Results:** The schizophrenia patient group performed significantly worse on all social-cognitive tasks than the healthy control group. Correlation analysis showed that ego disturbances were related to deficits in person attribution and lower levels of confidence in the source monitoring task. Also, ego disturbances were related to higher PANSS positive scores and a higher number of hospitalizations. Stepwise regression analysis revealed that social-cognitive variables explained 48.0% of the variance in the ego-disturbance score and represented the best predictors for ego disturbances. One particular clinical variable, namely the number of hospitalizations, additionally explained 13.8% of the variance. **Conclusion:** Our findings suggest that ego disturbances are related to deficits in the social-cognitive domain, and, to a lesser extent, to clinical variables such as the number of hospitalizations.

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Introduction

Throughout the last century, schizophrenia was traditionally referred to as an ego disorder by many psychiatrists [1–3]. This concept has been carried forward into

modern psychopathology by defining individual symptoms of ego disturbances that occur in some patients. The most influential definition was provided by Schneider [3, 4] who termed these symptoms 'first-rank symptoms' because they were regarded as primary for the diagnosis of schizophrenia. These included symptoms such as delusional and sense deception phenomena; thought insertion, withdrawal and broadcasting (and other forms of thought interference); feelings of being controlled by an external force; and everything in the spheres of feelings, drive and volition experienced as being imposed or influenced by others [4]. Concerning a common ground to these symptoms, Schneider [3, 4] suggested grouping them under the concept of 'permeability of the ego-world boundary', i.e. a disturbance of the ability to maintain a clear distinction between the self and the environment.

Regarding this permeability of the self, it can be assumed that patients with ego disturbances are impaired in the domain of social cognition, the ability to build representations about oneself and others, as well as about relations between oneself and others [5, 6]. An intact ego-world boundary is understood as a necessary condition for an adequate understanding of the subjective world of other people [7, 8]. On the other hand, a lack of discrimination between self and other, such as the perception that thoughts and actions are externally controlled or manipulated, might be associated with difficulties in correctly understanding social information.

Until now, social cognition – which represents a multidimensional construct including various processes such as source monitoring, emotion recognition, mental state recognition (theory of mind) and social causal attribution [5, 6] – has mainly been studied with regard to an influential hypothesis by Frith and Done [9–11]. They assumed that deficits in social cognition might be selectively impaired in relation to certain symptoms of schizophrenia. In line with this hypothesis, studies using different mental state recognition paradigms, such as first- and second-order false-belief tasks, hinting tasks and deception or animated sequence tasks, have found impairments in subjects with prominent behavioral or paranoid symptoms, but no impairments in patients with ego disturbances [11–15]. Only one study reported a worse performance, which may be due to the small sample size [16].

By contrast, source monitoring abilities have been shown to be selectively impaired in patients with ego disturbances [17–21], with only a few studies showing conflicting results [22–24].

Regarding social causal attribution, so far one study has investigated causal attribution in patients displaying

ego disturbances, demonstrating a tendency to internally attribute, i.e. to blame oneself, for task-related events [22].

Taken together, these results could be integrated into the classification of social-cognitive processes of Lieberman and colleagues [25, 26] by speculating that ego disturbances might be related to impairments in internal domains of social cognition, such as source monitoring or social causal attribution, which rely on reflective, mental and emotional aspects of oneself and other individuals. By contrast, processes focusing on external, physical and visual characteristics of oneself and others, like mental state recognition or emotion recognition, seem to be relatively intact.

However, studies that systematically investigate a range of social-cognitive processes in relation to ego disturbances are so far lacking. Therefore, the goal of our investigation was to explore this relationship in more detail in a sample of schizophrenia patients and a control sample. The specific objectives of the study were to compare the patient and the control sample on a variety of social-cognitive tasks encompassing source monitoring, emotion recognition, mental state recognition and social causal attribution, and to analyze the influence of social-cognitive and clinical variables on ego disturbances. Based on previous research, we expected significant associations between source monitoring impairments, social causal attribution deficits and ego disturbances.

Methods

Subjects

Schizophrenia Group

The schizophrenia group (SG) comprised 40 patients (28 men, 12 women, mean age = 38.3 years, SD = 9.8) with an ICD-10 diagnosis of schizophrenia in full or partial remission (ICD-10 F20. ×4/×5). Patients were recruited from the outpatient service of the Psychiatric University Hospital Zurich (n = 35) and the inpatient ward of a teaching hospital of the University of Zurich, the 'Sanatorium Kilchberg' (n = 5).

Exclusion criteria for patients were: (1) a different main diagnosis than schizophrenia (F20.0–F20.3), (2) age under 20 or over 60 years, (3) history of any brain injury or neurological illness, (4) vision reduction, (5) an axis II disorder (DSM-IV), (6) cognitive impairments, and (7) not fluent enough in the German language to follow instructions. Of the 40 patients, 33 were receiving antipsychotic medication: mean chlorpromazine equivalents (CPZe) were 410.8 (SD = 360.3); CPZe for second-generation antipsychotics were calculated according to Woods [74]. Mean IQ, estimated by the raw Score on the Multiple Vocabulary Test B [27] measuring verbal-dependent intelligence was 109.0 (SD = 13.5). The average duration of illness was 15.4 years (SD = 19.8). All but two patients were right-handed [28]. Clinical assessment was made by personal interview on the day of testing by two trained psycholo-

Table 1. Sociodemographic variables of the sample

	Schizophrenia group (n = 40)			Control group (n = 39)			Statistics	p
	mean	SD	MD	mean	SD	MD		
<i>Sociodemographic variables</i>								
Sex (male:female)	28:12			22:17			$\chi^2 = 1.5$	n.s.
Age, years	38.5	9.8		34.4	9.7		F (1,77) = 3.1	n.s.
IQ	109	13.5		115.7	24.5		F (1,77) = 2.2	n.s.
Handedness (right:left) ¹	89.9	40.5	100	88.0	34.4	100	U = 760	n.s.
Education, years	12.5	1.7	13	13.9	2.1	13	U = 503.5	<0.01
<i>Illness-related variables</i>								
Duration of illness, years	15.4	19.8						
Number of hospitalizations	3.3	4.3						
PANSS positive	15.8	3.3						
PANSS negative	22.3	7.2						
PANSS general	29.3	5.1						
PANSS overall	67.6	13.2						
Mean antipsychotic dose, CPZe	410.8	360.3						
<i>Social-cognitive variables</i>								
Source monitoring task								
Sensitivity index	73	6.7		79.8	10.4		F (1,77) = 4.9	<0.05
Certainty rating	1.4	0.3		1.4	0.3		F (1,77) = 0.0	n.s.
Emotion recognition in prosody	8.1	8.5	8.5	8.9	1.4	8.5	U = 569.5	<0.05
Reading the mind in the eyes	23.1	3.1		25.5	2.6		F (1,77) = 12.9	<0.01
Attribution task								
Incorrect person attribution	5.7	5.4		3.2	2.7		F (1,77) = 12.8	<0.01
Incorrect object attribution	9.5	4.0		7.0	3.5		F (1,77) = 8.3	<0.05
Incorrect situational attribution	3.6	2.6		2.4	2.0		F (1,77) = 4.2	<0.05
MD = Mean deviation. ¹ Raw score, not standardized.								

gists using the German version of the Positive and Negative Syndrome Scale (PANSS) [29]. Seventeen subjects met the criteria for the paranoid type of schizophrenia, two for the hebephrenic type and 21 for the undifferentiated type.

All patients were clinically stable at the time of testing and gave written informed consent to participate in the study, which had been approved by the local ethics committee. Our study was conducted in accordance with the guidelines of the Declaration of Helsinki. Descriptive information for the patient and control groups is provided in table 1.

Control Group

The control group (CG) comprised 39 healthy control subjects (22 men, 17 women, mean age = 34.46, SD = 9.7 years) recruited at the University of Zurich (n = 15), in adult education facilities (n = 19) and among hospital staff (n = 5). Exclusion criteria for the control subjects were: (1) history of any brain injury or neurological illness, (2) age under 20 or over 60 years, (3) cognitive impairments, (4) history of habitual alcohol or drug abuse or current abuse, (5) vision reduction, (6) history of schizophrenia or related disorders, (7) current depression, and (8) not sufficiently fluent in the German language to follow the instructions. All control sub-

jects but one were right-handed [28] and the main IQ score, estimated by the score on the MWT-B [27], was 115.7 (SD = 24.5).

Measures and Procedures

Ego Disturbances

We used the Ego-Disturbance Scale from the Working Group on Methodology and Documentation in Psychiatry (AMDP) for the assessment of ego disturbances in the SG [30, 31]. The scale contains the following items: (1) thought broadcasting, (2) thought withdrawal, (3) thought insertion, (4) derealization, (5) depersonalization, and (6) other symptoms of alien control, following a proposal of Loftus et al. [32]. Each item was scored from 0 to 3 (0 = nonexistent, 1 = mild, 2 = medium, 3 = heavy), for a maximum score of 18 in total.

The Source Monitoring Task

Source monitoring was investigated by means of an established source monitoring task [33, 34]. Participants performed simple right-handed mouse movements towards a white target object (an asterisk) appearing either on the upper left or the right side of a black computer screen. Movements could be tracked visually in the form of a cursor displayed on the screen. The cursor

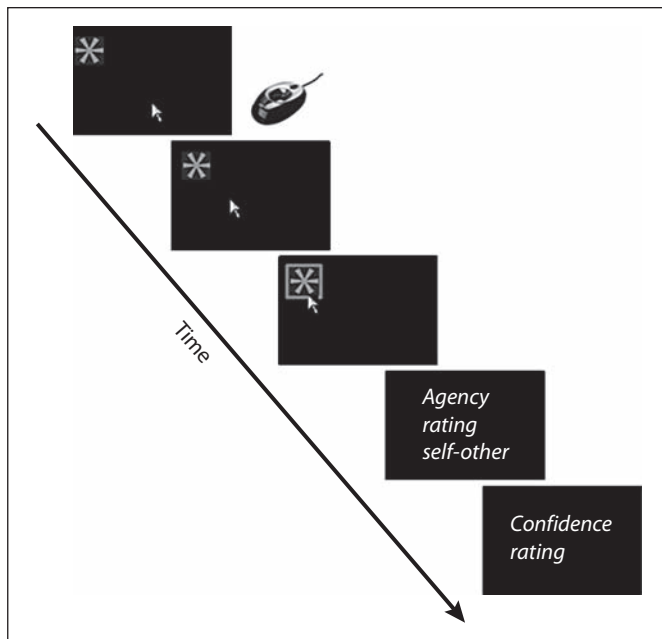


Fig. 1. Source monitoring task and design. Subjects saw the asterisk which appeared either on the left or right side of the screen, they had to move the mouse towards the asterisk. After hitting the asterisk, subjects had to evaluate whether the visual feedback had matched their executed movement or not and how confident they were of their judgment.

movement matched the subjects' executed movements only in 50% of the trials (real feedback, RF). In the other 50%, a randomly selected movement from a previous trial of the participant was replayed (false feedback, FF). To avoid systematic differences between RF and FF, false movements always went in the same direction as the subject's intended movements, but they could differ in regard to onset, speed and path deviations. As a cover story, participants were told that on some trials they would see the experimenter's movements who performed the task in the adjacent room, instead of their own movements (see fig. 1 for a graphic depiction of the task).

Subjects were told to monitor the movements carefully and to indicate after each trial whether they were the agent of the observed movement (self) or not (other) by pressing the corresponding button (for more details on the source monitoring task see David et al. [33, 34]). The task thus yielded a quasi 2×2 design with the first factor feedback (real vs. false) and the second factor evaluation (self vs. other). In a second judgment, participants indicated their confidence in their decision on a 4-point rating scale (1 = certain, 2 = rather certain, 3 = rather uncertain, 4 = uncertain). (The second scale was included as an additional rating to assess the confidence with which the evaluation of self or other was made.)

The task was conducted on a DELL Optiplex 755 computer (1,680 \times 1,050 resolution), employing the Presentation software (Neurobehavioral Systems, Albany, Calif., USA). Each participant

read standardized written instruction before the test started, followed by 20 practice trials to become used to the task procedure. The task consisted of a total of 200 trials, of which 100 were RF and 100 were FF (50 trials to the left and 50 trials to the right target). It was carried out in 3 short runs of approximately 8 min.

The Emotion-Recognition Task

The emotion-recognition task was designed by Edwards et al. [35] and demanded the identification of 6 basic emotions by means of spoken sentences: sadness, anger, happiness, disgust, surprise and fear. The content of the sentences was neutral and consisted of simple statements, for example: 'She will drive fast'. To test the ability of the subjects to understand general prosodic cues, a control task was used consisting of two questions and two declarative sentences that had to be correctly identified before starting the test. The main test was composed of 12 sentences. Each emotion appeared two times. Including the 4 control sentences, the task contained 16 trials. Response categories were coded as 0 = incorrect and 1 = correct.

The 'Reading-the-Mind-in-the-Eyes' Task

The 'reading-the-mind-in-the-eyes' task [36] is aimed at assessing mental state recognition abilities. The test consisted of 36 pictures showing expressive pairs of male or female eyes. Each picture was presented with 4 choices of adjectives. Subjects were asked to choose the adjective that best describes the mental state of the person (i.e. as expressed by his/her eyes). A global accuracy score according to Baron-Cohen et al. [36] ranging from 0 to 36 was computed.

The Attribution Task

The attribution task used in our study is based on the attribution theory of Kelley and Levine [37] and was designed by Rössler and Lackus [38]. Kelley and Levine [37] proposed that each action, behavior or event can be attributed to three categories of causes: the person that performs an action, the object the action is directed to, or the circumstances or situation in which the action takes place. While person and object categories can be understood as relatively stable categories, attributing a cause to the circumstances of a situation is more of an unstable and transient causal category. Kelley and Levine [37] assumed that in order to make the correct attribution, the observer analyzes all available information in terms of three categories, namely consensus, distinctiveness and consistency. Using 'Susie is afraid of the dog' as an example:

Consensus (across persons): is high if several other people are afraid of the dog and low if nobody else is afraid of the dog. In the case of low consensus, the observer would attribute the fear to Susie's character as a stable disposition.

Distinctiveness (over entities): is high if Susie is only afraid of this dog and low if Susie is afraid of all dogs. In the case of high distinctiveness, the observer would conclude that this dog is responsible for Susie's fear.

Consistency (over time): is high if Susie is always afraid of the dog and low if Susie is afraid of the dog only once. In the case of low consistency, the observer would conclude that situational circumstances are responsible for Susie's fear.

In our setup, the participants were presented with depictions of 18 written social events on a computer screen. Each description of an event was presented three times, in each case with changing

additional information regarding the consensus, distinctiveness and consistency of the event, for example: Susie is afraid of the dog, (1) nobody else is afraid of this dog (low consensus); (2) Susie is not afraid of other dogs (high distinctiveness); (3) usually Susie is not afraid of this dog (low consistency). Each description indicated a specific causal attribution (person, object and situation) according to the theory of Kelley and Levine [37]. To eliminate interfering variables, none of the depictions of social events contained references to emotional states. A person attribution error was classified if participants made false person attributions in cases where demanded object or situational attributions were called for. Similarly, object and situational errors were classified if participants did not choose the appropriate attribution.

Statistical Analysis

Data were analyzed using SPSS version 19 software for Windows (SPSS Inc., Chicago, Ill., USA). The normal distribution of data was verified by the Kolmogorov-Smirnov test. Analyses of significant differences between the study groups were calculated by applying a one-way ANOVA, given that the normality assumption was met. Non-normally distributed variables were analyzed using the Mann-Whitney U test. The χ^2 test was used to analyze possible age differences between groups.

In a first step, ANOVAs were used to determine whether there were significant differences in sociodemographic variables and in the social-cognitive task performance between the CG and the SG. As dependent variables for the source monitoring task, we used (1) the sensitivity index (number of correct trials – number of incorrect trials) and (2) the degree of confidence of the self-other evaluation, which was calculated as a new variable; the mean confidence score (the sum of all four ratings divided by the total number of ratings, resulting in a number between 1 and 4). As dependent variables for the emotion recognition task, the number of correctly identified general prosodic cues in the control task and of correctly identified emotions in the main task were used. For the mental state recognition task the number of correctly identified mental states was used as dependent variable. For the attribution test, false person, object and situational attributions were used as dependent variables.

Bivariate Pearson and Spearman correlations between ego disturbances and social-cognitive and clinical variables were calculated. In a second step, a stepwise regression analysis was used to model if the degree of ego disturbance in the SG could be predicted by social-cognitive functioning and clinical variables. A positive correlation between ego disturbances and the PANSS positive scale was found, which represents an overlap between the concepts of ego disorder and positive symptoms. Therefore the PANSS positive scale was excluded as an explaining variable from the regression analysis. Levels of significance were set at $p < 0.05$.

Results

Comparison between the SG and the CG

Descriptions of the two samples regarding sociodemographic data, clinical data and results of the social cognitive tasks are shown in table 1. SG and CG differed significantly in education ($U = 503.5$, $p < 0.01$) and in all

Table 2. Relationship between social-cognitive and clinical variables and the ego disturbance score

	Pearson's r	p
<i>Sociodemographic variables</i>		
Age	0.287	n.s.
IQ	–0.038	n.s.
Education	–0.027	n.s.
<i>Illness-related variables</i>		
Duration of illness	0.020	n.s.
Number of hospitalizations	0.348	<0.05
PANSS positive	0.491	<0.001
PANSS negative	0.144	n.s.
PANSS general	0.223	n.s.
Mean antipsychotic dose, CPZe	–0.094	n.s.
<i>Social-cognitive variables</i>		
Source monitoring task		
Sensitivity index	0.208	n.s.
Certainty rating	0.343	<0.05
Emotion recognition in prosody	0.091	n.s.
Reading the mind in the eyes	0.117	n.s.
Attribution task		
Incorrect person attribution	0.345	<0.05
Incorrect object attribution	0.260	n.s.
Incorrect situational attribution	0.129	n.s.

social cognitive tasks (all $F > 3.6$, all $p < 0.05$), with the SG being less educated and performing worse on all applied social cognitive tasks. The only measure that was not different was the confidence rating in the source monitoring task, where the SG showed the same amount of confidence in their self-other evaluation as the CG ($F = 0.0$, $p > 0.05$).

Correlation Analysis between Ego Disturbances and Social-Cognitive and Clinical Measures

To evaluate the relationship between ego disturbances and social-cognitive, socio-demographic and clinical variables, correlation analyses were performed (table 2). From the social-cognitive variables, the ego-disturbance score was significantly correlated with the confidence rating of the source monitoring task. With respect to clinical variables, correlations were found with the number of hospitalizations and with the PANSS positive score.

Regression Analysis between Ego Disturbances and Social Cognitive and Clinical Measures

Table 3 shows the hierarchical regression analysis for ego disturbances. The results of the analysis show that a higher number of person attribution errors ($\beta = 0.61$, $p <$

Table 3. Linear regression analysis (stepwise) with the ego disturbance score as the dependent variable

	corr ΔR^2	F	p
Model 1	0.171	6.764 (1, 27)	<0.050
Model 2	0.480	13.900 (2, 26)	<0.000
Model 3	0.618	16.083 (3, 25)	<0.000
	β	t	p
Model 1			
Incorrect person attributions	0.448	2.601	<0.05
Model 2			
Incorrect person attributions	0.609	4.296	<0.000
Certainty rating	0.585	4.126	<0.000
Model 3			
Incorrect person attributions	0.610	5.019	<0.000
Certainty rating	0.518	4.202	<0.000
Number of hospitalizations	0.383	3.225	<0.000

0.05), elevated levels of confidence in the self-other rating ($\beta = 0.51$, $p < 0.01$) and a higher number of hospitalizations ($\beta = 0.38$, $p < 0.01$) were significant predictors for the presence of ego disturbances. The three independent variables accounted for 61.8% of the variance in ego disturbances ($F = 16.0$, $p < 0.01$).

Discussion

The present study compared four domains of social cognition in a sample of schizophrenia patients and a sample of healthy controls and, in a second step, analyzed the relationship between social-cognitive and clinical variables and the presence of ego disturbances.

In line with previous research, we found that schizophrenia patients had deficits in all four examined domains of social cognition [39–43]. According to our hypothesis, the performance in the social-cognitive tests explained almost half of the variance of the ego disturbance score. Within the social-cognitive battery, internally oriented social-cognitive domains – such as social causal attribution or the metacognitive confidence judgment in the source monitoring task – were predictive of ego disturbances, whereas externally oriented processes – such as basic emotion recognition or mental state recognition – were not predictive variables. The number of hospitalizations also had a predictive effect. Contrary to our hypothesis, no association was found between the

self-other evaluation in the source monitoring task and ego disturbances.

So far, in line with our results, a number of studies have demonstrated significant deficits in all investigated domains of social cognition with a clear impact on functional outcome and implications for treatment guidelines [for review articles, see 41, 44–46].

Regarding the specific deficits in relation to ego disturbances, different factors have been discussed [47–49]. It has been suggested that abnormalities – such as temporal lobe pathology [49], abnormal activity in the parietal lobe [50, 51], alterations in associative higher-order neuronal circuits such as the mirror-neuron system [47, 52], reduced cerebral asymmetry [53] or time perception deficits [54] – might be relevant factors associated with ego disturbances. Regarding social-cognitive processes, only source monitoring deficits, important in securing self-other differentiation, have been discussed as central to the formation of ego disturbances [17, 51, 55]. Our results suggest that deficits in other internally focused social-cognitive processes, like social causal attribution, could be similarly important factors.

Social causal attribution in general must be understood as a process encompassing internally and externally oriented aspects of social cognition since causes of events can be attributed to persons or to external factors like objects or situations. In line with this differentiation, neuroimaging evidence shows that person attribution is associated with activation of brain areas related to internally oriented activity [56]. In a more concrete sense, an internalizing attribution style characterized by a high number of person attribution errors means that a subject is considered responsible for an event, not an object or a situation. Rössler and Lackus [38] point out that a preference for stable (person or object) over unstable categories (situation) can be understood as an attempt to gain control and make the outside world more predictable. Situation attributions are complex and imply little prognostic value for future events. Person attributions, by contrast, are easier and allow forecasts of the behavior of people in future situations. Our study results suggest that an inflexible attribution style with an overemphasis on person attribution might be a risk factor for the emergence of ego disturbances [57]. In line with our results, a study by Fournier et al. [22] using a source monitoring task shows that patients with ego disturbances were unable to attribute the differences between visual information and motor information externally to the computer, but attributed them to internal factors such as tiredness, lack of concentration or effects of the disease. Symptoms of ego distur-

bances in general are associated with a great loss of control over the self and self-experience. Attributing causes of events to a person might be an attempt to restore control. The negative effect of this strategy is, however, the creation of fear and isolation, since events cannot be adequately understood and judged. In line with this idea, Mizrahi et al. [43] show that a high level of person attributions is associated with more psychopathology and less response to treatment. In this regard, it would be interesting for a future study to use attribution tasks investigating real-life attribution patterns derived from patients' narratives, such as reported in a study by Aakre et al. [42], to more closely understand the nature of attribution deficits in this patient group.

Regarding the source monitoring task, contrary to our hypothesis we did not find an association between these performance deficits and ego disturbances. Several factors could account for this negative finding. First, our source monitoring paradigm might not have been subtle and complex enough to detect specific deficits in patients with ego disturbances. In other studies, paradigms with several experimental conditions were used. For example Daprati et al. [18] used a paradigm with three experimental conditions and found differences only in the most complex condition, where subject and experimenter had to perform exactly the same movement. By contrast, in our task the subjects could use temporal as well as spatial cues to evaluate movements as self- or other-generated. Secondly, it is possible that mild ego disturbances are not related to deficits in action monitoring, but to a lower level of confidence in one's own performance. So far, several studies have shown that patients with schizophrenia exhibit deficits in metacognition, i.e. the judgment of one's own performance in a test [58, 59]. However, the relationship between metacognition and ego disturbances has not yet been investigated. Morrison and Haddock [60] found no relationship between symptoms of hallucinations and metacognition. Moritz and Woodward [61] found a positive relationship between symptoms of delusions and hallucinations and elevated levels of confidence in a word learning task; however, passivity experiences were not included either. Reduced levels of confidence in one's own performance have been demonstrated for other psychiatric disorders like depression [62, 63] and obsessive-compulsive disorder [64, 65], leading to specific symptoms like rumination or checking, respectively. Regarding schizophrenia, more studies including patients with moderate-to-severe symptoms of ego disturbances are needed to investigate whether ego disturbances are associated with lower confidence in all

performance tasks or only in source monitoring tasks, and whether patients with stronger symptoms, by contrast, show higher levels of confidence as suggested in the study by Moritz and Woodward [61].

The third significant predictor in our study is the number of hospitalizations. Previous studies have established hospitalization as a predictor for several negative outcomes such as a higher risk for suicide [66], relapse [67, 68], switching antipsychotics [69], the experience of criticism and hostility from relatives [70], and a more severe course of illness and lower social functioning [71]. In our study, it was the only clinical variable predicting ego disturbances. One interpretation could be that a higher number of positive symptoms, especially symptoms of ego disturbances, involve an increased risk of being hospitalized, as research suggests [72]. However, more studies are needed to validate our findings.

Lastly, in the recognition of emotions and the perception of mental states, no specific impairments in relation to first-rank symptoms were detected. These findings support our hypothesis that ego disturbances per se do not seem to interfere with externally oriented domains of social cognition.

Finally, some methodological points deserve consideration. First, as mentioned above, the patients with ego disturbances were only mildly symptomatic at the time of testing and encompassed only 12 out of 40 patients. Therefore, our results have to be interpreted with caution and should be replicated in larger samples.

Second, it is possible that the results are explainable by the fact that the patients with ego disturbances were more severely ill than the other patients as suggested by the correlation of the ego disturbances score with the PANSS positive score and with the number of hospitalizations. However, and arguing against this explanation, we did not find a correlation of the ego-disturbance score with any other clinical variables. The high correlation between the PANSS positive score and the ego-disturbance score suggests rather that by applying the AMDP scale our concept of ego disturbances might have been too narrow. Only passivity items and two items associated with delusions (derealization, depersonalization) were included. Sense deception items like hallucinations and other delusional items like grandiosity were not included, as suggested by other instruments such as the SAPS scale or the ICD-10 criteria. The correlation between the PANSS positive scale and the AMDP scale shows that ego disturbances should be investigated with instruments encompassing all three types of phenomena: passivity symptoms, sense deception symptoms and delusional

phenomena, as described by previous studies [22, 53, 54, 73]. Additionally, ego disturbances were not associated with a higher PANSS negative or PANSS general scores, suggesting that the patient group with ego disturbances was not more severely ill.

To sum up, a high number of person attributions, a lower confidence in own performance in the source monitoring task and a higher number of hospitalizations were the main predictors for ego disturbances. The deficits were mainly found in the sphere of internally focused processes, following an important classification of Lieberman and colleagues [25, 26]. Our findings have

clear implications for clinical practice. Cognitive and behavioral interventions that specifically target patients' attribution styles and their confidence regarding their ability in self-other differentiation may help to treat the symptoms of individuals suffering from ego disturbances. Our results also suggest that the impact of this symptomatology should not be only studied in the area of neurobiology and motor cognition, but also in the area of social cognition, where heterogeneity considering specific deficits in the schizophrenia spectrum disorder has been shown.

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